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ABSTRACT

A study compared the test scores of National Fire Academy (NFA) students who received on-campus classroom instruction and students who received the same instruction delivered by satellite teleconference. Following a review of literature that indicated no significant difference in test scores between on-campus classroom students and teleconference students, a controlled study was set up. The subjects were males between 35 and 55 years of age who held chief officer positions in fire departments around the country. The control group consisted of 34 students attending an executive development course at the NFA, and the experimental group consisted of 35 students attending a teleconference site. The test instrument developed for this study was a criterion-referenced, multiple-choice, 10-item test, examined for reliability and validity. Both groups received identical lectures, one live and one taped. The satellite teleconference group had a mean score of 7.3, whereas the control group had a mean score of 9.6. It is concluded that although the on-campus group scored higher on the test, both groups did learn. The difference may be in student motivation to use the information; however, the study demonstrated that teleconferencing was less effective than classroom instruction. It is recommended that comprehensive instructional development technology should be included in the design and implementation of teleconferences in order to increase learning. (KC)

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COMPARISON OF ACHIEVEMENT OF STUDENTS IN ON-CAMPUS CLASSROOM INSTRUCTION VERSUS SATELLITE TELECONFERENCE INSTRUCTION

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INTRODUCTION

The National Fire Academy (NFA) delivers part of its instruction by satellite teleconference. This method of instruction has never been compared to on-campus classroom instruction. The problem is that faculty at the NFA do not know if one method of delivery is more effective than the other.

The purpose of this study is to compare the test scores between students that receive an on-campus classroom instructional method and students that receive the same instruction delivered by satellite teleconference instruction. This study is quasi-experimental research. The research hypothesis is: There will be no statistically significant difference in test scores between NFA students that receive on-campus classroom instruction and students that receive the same instruction by satellite teleconference instruction.

The NFA's mission is to increase the professionalism of the nation's fire service and other allied professionals engaged in fire prevention and control activities. To accomplish its mission, the NFA conducts on-campus courses for 4000 students annually, field based courses for 15,000 students annually, and teleconferences which reach approximately 75,000 students during each broadcast. Annually there are three to six teleconferences conducted by the NFA faculty. For the first time NFA management is asking if the teleconference is an effective instructional methodology, in terms of student learning.

Literature Review

The literature reviewed for this study included information on instructional television, telecourses, videotaped instruction, and live video teleconferencing. Of the four areas, live video teleconferencing is the newest (Barker, 1987:42). There were no studies found that compared the effectiveness of classroom instruction to satellite teleconference instruction. Brown (1988:24) states that, "Earlier research on development and application for educational television may be applicable to the video teleconference."

The specific area of interest to this study is the comparison of classroom instruction to instruction using television. "Many studies, including those at the college and university level, have shown that students who learn through telecourses achieve at least as well as those who receive traditional instruction" (Daniel, 1988:14). When Dutton (1988) compared the test results of graduate engineering students who received classroom instruction through videotape, of the classroom instruction, the results indicated no statistical significant difference.

The conclusions of Daniel and Dutton (1988) are not unexpected because there have been hundreds of studies comparing the effectiveness of classroom teaching to instructional television. Chu and Schramm reviewed the literature comparing classroom instruction to instructional T.V. from 1957 through 1966 and concluded, "...all these summaries show that in the great majority of comparative studies, there is no significant difference between learning from

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television and learning from conventional teaching; and that where there is a significant difference, it is a bit more likely to be in favor of television than of conventional instruction" (1967:6). A more recent review, of more than 100 research reports from 1971 to 1986, by Whittington (1987) affirms the conclusion that instructional television is as effective as traditional methods.

The literature that was reviewed affirms the research hypothesis of this study, that there will be no significant difference in test scores between the on-campus classroom student and the teleconference student. This study contradicts the literature.

PROCEDURES

Population

The subjects involved in this study were males between 35 and 55 years of age who hold chief officer positions in fire departments around the country. Subjects were students attending a NFA on-campus course titled Executive Development III and students attending a NFA teleconference titled Increasing Fire Department Effectiveness Through Organizational Development. Both groups of students received the same one-hour module of instruction.

The control group consisted of 34 students attending an Executive Development III course at the NFA in Emmitsburg, Maryland. The Assistant Superintendent designated the class assigned as the control group. Students voluntarily applied for the course and were assigned by the NFA's admissions office. The only admission requirement is that the student meet the Executive Development III student selection criteria as outlined in the course catalog. Students must be chief fire officers, directors of state fire agencies, or government officials (FEMA, 1987).

The experimental group consisted of 35 students attending a teleconference site. Teleconference sites are typically fire department training centers that have equipment to receive satellite broadcasts. Four teleconference sites across the country were designated by the Assistant Superintendent as the experimental group. The teleconference program was advertised nationally and students voluntarily attend the teleconference site. There is no selection criteria for students attending these programs. The advertisement for this program states: "This program will be of interest to fire service executives, city and county managers, faculty and students and allied professionals in public administration" (FEMA, 1988:3). Only two of the students in the experimental group met the selection criteria for Executive Development III. However, the two groups were equal based on a comparison of there pretest scores.

Instrumentation

The test instrument developed specifically for this study was a criteria referenced, multiple choice, ten item test. Content validity was determined by three experts. They were an organizational development consultant, an evaluation specialist, and a curriculum development specialist. Each person compared the test instrument to the lecture outline. The conclusion was that the test had item validity because the questions matched the lecture content and the test had sampling validity because the questions covered the total lecture content (Gay, 1981).

Reliability was determined by administering the test to 28 Executive Development III graduates and applying a split-half reliability procedure to the data. The split-half reliability coefficient was .76. The Spearman-Brown

formula indicates a total test reliability of .86. The standard error of measurement was .37. The test instrument was accepted as valid and reliable for this study.

Collection of Data

The Organizational Development module of the Executive Development III course was taught during the teleconference and classroom instruction. A 60 minute video tape of the classroom lecture was made. The video tape was broadcast live during the NFA teleconference titled Increasing Fire Department Effectiveness Through Organizational Development. On-campus classroom students and teleconference students received identical lecture outline materials, which were used during the instruction.

On-campus students were pretested with the instrument developed for this study. The test was administered and collected by a NFA faculty member. After the pretests were collected, the lecture outline material was distributed to the students. A NFA faculty member then conducted the one hour lecture. At the conclusion of the lecture a closed book test was administered. The posttest was the same instrument used for the pretest and it was administered by the same NFA faculty member.

Teleconference students were pretested with the instrument developed for this study. The test was administered and collected by a facilitator at each of the four teleconference locations. After the pretests were collected, the lecture outline material was distributed; students then viewed the teleconference broadcast. At the end of the one-hour lecture, teleconference students had the opportunity to phone into the studio to ask questions and receive answers about the lecture. The question and answer period lasted 30 minutes. At the conclusion of the question and answer period, the facilitator administered the closed book posttest. The facilitator mailed the pre and posttest instruments to the NFA.

This study was a quasi-experimental design because the control and experimental groups could not be randomly selected or assigned. Permission from the NFA was granted to use one Executive Development III class and four teleconference sites.

Statistical Analysis

An independent t test was conducted on the experimental and control group pretest scores. This was a one-tailed test at a .01 level of significance. An independent t test was conducted on the posttest scores. This was also a one-tailed test at a .01 level of significance. The reason for choosing this statistical analysis is as follows. First, the homogeneity of the control and experimental groups needed to be determined. By conducting a t test on the pretest, this was determined. Second, the t test was chosen because of the small number of cases. Third, the .01 level of significance was selected to reduce the chance of committing a type I error.

Null hypotheses: There will be no statistically significant difference between test scores of students that receive on-campus classroom instruction (control) and students who receive the same instruction by satellite teleconference instruction (experimental).

Alternative hypothesis A: The control group will have a significantly higher mean test score than the experimental group.

Alternative hypothesis B: The experimental group will have a significantly higher mean test score than the control group.

Assumptions and Limitations

The first assumption is that the test instruments were administered to the experimental groups correctly by four different facilitators. Detailed written and verbal instructions were given to each facilitator. It is assumed that the facilitators followed the instruction exactly. The second assumption is that the control and experimental groups are homogeneous in terms of intelligence and motivation.

There are four limitations that threaten the external validity of this study. First, pretesting the students sensitized them to the content of the lecture. In addition, pretesting is not normally conducted for on-campus courses or satellite teleconference instruction. In this study, pretesting was conducted in order to help determine internal validity. Second, generalization of the findings are questionable because of the small samples that were available to this study; an on-campus control group of 34 compared to a population of 4,000; a teleconference site experimental group of 35 compared to a population of 75,000. Third, another problem of generalization is caused by the subject matter being studied. The results relate to only one module of instruction when there are hundreds of modules of different content taught at the NFA. Finally, the lecture method of instruction is the only methodology being used in this study. There are many other methods used at the NFA for both on-campus and teleconference delivery.

The limitation that threatens the internal validity of the study is the differential selection of subjects. Students that volunteer to attend an on-campus course may be more knowledgeable about the information being taught than the students volunteering to attend the teleconference. Because of this, the pretest scores of the control and experimental group were compared. Another limitation is the one-hour length of instruction. This was necessary to insure that both groups received the exact same instruction.

Definition of Terms

The National Fire Academy is part of the Federal Emergency Management Agency, under the executive branch of the United States government.

Course - structured complete blocks or modules of instruction resulting in the reward of a certificate for successful completion.

On-Campus - a training activity delivered using funds from resident programs line item of the budget. In this study, it also means a two week long course.

Module - a block of instruction which may be delivered independently or as part of a training activity. In this study, it refers to a three-hour block of instruction; one-hour of lecture, one-hour of student activity, and one-hour of discussion.

Teleconference - an educational program delivered through an electronic medium such as satellite broadcasting where there is no continual direct contact between instructors and students. In this study, a teleconference is three-hours of broadcasting which contain both live and video tape delivery as well as two way audio communications.

RESULTS

The experimental group, teleconference, consisted of 35 students, their mean score on the pretest was 6.429, with a low score of 1 and a high score of 9. The standard deviation was 2.297, and the standard error of measure was .385. The control group, on-campus, consisted of 34 students, their mean score on the pretest was 7.382, with a low score of 4 and a high score of 10. The standard deviation was 1.538, and the standard error of measure was .264. An independent t test was conducted at the .01 level of significance. The

calculated t was 2.032 and the critical t was 2.666. The calculated t is less than the critical t (Table 1).

Table 1

Comparison of Pretest Scores of
On-Campus and Teleconference Groups

Students	N	$\bar{X}$*	Score Low	Score High	Standard Deviation	Standard Error of Measure
On Campus	34	7.382	4	10	1.538	.264
Teleconference	35	6.429	1	9	2.279	.385

*No statistically significant difference at P=.01, calculated t 2.032, critical t 2.666.

The posttest results are as follows. The experimental, satellite teleconference, group had a mean score of 7.257, with a low score of 3 and a high score of 10. The standard deviation is 2.091 and the standard error of measure is .353. The control, on-campus, group had a mean score of 9.588, with a low score of 7 and a high score of 10. The standard deviation was .701 and the standard error of measure was .12. An independent t test was conducted at the .01 level of significance. The calculated t was 6.17 and the critical t was 2.666. The calculated t was greater than the critical t (Table 2).

Table 2

Comparison of Posttest Scores of
On-Campus and Teleconference Groups

Students	N	$\bar{X}$*	Score Low	Score High	Standard Deviation	Standard Error of Measure
On Campus	34	9.588	7	10	.701	.12
Teleconference	35	7.257	3	10	2.091	.353

*Statistically significant difference at P=.01, calculated t 6.17, critical t 2.666.

A comparison between pre and posttest scores for each group was conducted. A dependent t test was conducted on both sets of scores. The video teleconference group had a calculated t of 2.666. The critical t at the .05 level of significance is 2.042. The calculated t was greater than the critical t. The on-campus group had a calculated t of 7.261, the critical t at the .001 level of significance was 3.646. The calculated t exceeds the critical t (Table 3).

Table 3

Comparison of Pretest to Posttest Scores of
On-Campus and Teleconference Groups

Students	N	Pretest / Posttest $\bar{X}$		Level of Significance	Calculated t	Critical t
On Campus	34	7.382	9.588	.001	7.261	3.646
Teleconference	35	6.429	7.257	.05	2.666	2.042

DISCUSSION

The null hypothesis was rejected, the research hypothesis was also rejected; alternative hypothesis (a) was accepted. The on-campus control group scored significantly higher on the posttest than the satellite teleconference experimental group. The control mean was 9.588 and the experimental mean was 7.257, which is statistically significant at the .01 level.

Although the studies of Chu (1967), Wittington (1987), and Dutton (1988) support the research hypothesis, the studies cited are comparing classroom instruction to instructional television. In these comparisons, the target audience for each type on instructional method was the same. The students in these studies are attending the same course, its only the medium that was different. Brown's (1988) notion that instructional television research may apply to satellite teleconferencing was not supported by this study. The major difference between the two methodologies is that instructional television implies course and teleconference does not imply course.

There are a number of differences between NFA on-campus courses and NFA teleconferences. On-campus courses are specifically designed for a target audience, only those who meet the target audience selection criteria can attend, and only a few have the opportunity to attend because of limited space. Teleconferences, although developed for a specific target audience, have no selection process; literally anyone with a satellite dish can watch a teleconference. This difference in the selection process between the two groups was taken into consideration.

The homogeneity of the two groups was determined by comparing their pretest scores to each other; there was no statistically significant difference between the scores. The students entry level knowledge of the subject matter was the same, but the groups were not equal in their organizational position. The control group all meet the student selection criteria of being top management. Of the 35 experimental students, only two were members of top management and would have met the Executive Development III student selection criteria. Because the teleconference group was less likely to be able to use the information being taught, it may have impacted on their motivation to learn the information. In addition, the information taught was designed for a specific target audience, Executive Development III, the experimental group did not fall into that target population. This may also have negatively influenced their ability to learn as much as the control group.

Despite the fact that the research hypothesis was rejected, both the experimental and control group did learn. This is evident from a comparison for each group's pre to posttest scores. There was a statistically significant difference between the pretest mean of 6.429, for the teleconference group, and their posttest mean of 7.257 at the .05 level of

significance. This result does support the literature which indicates that students can learn through instructional television. It also indicates that students can learn from satellite teleconference instruction when on-campus classroom instruction is videotaped and broadcast live. The control group, on-campus, had a pretest mean of 7.382 and a posttest mean of 9.588; this is statistically significant at the .001 level of significance. The difference between the gains in pre to post scores may again be influenced by student motivation to use the information and instructional design of the material.

Finally, although the teleconference students did not learn equally as well as the on-campus students, they did learn. Teleconferencing may not be as effective as instructional television or classroom instruction, but it can be an effective instructional methodology; when the classroom lecture video tape method is used with students that are homogeneous in regard to their entry level knowledge of the content.

IMPLICATIONS AND RECOMMENDATIONS

It is evident from this study that the participants do learn from teleconferencing, but they do not learn as much as students receiving the same instruction in the classroom. Teleconferencing is not as effective as on-campus classroom instruction. Institutions must decide if the objective of teleconferencing is to make it equally as effective as classroom instruction. To accomplish this, the same instructional development procedures need to be applied to teleconferencing, as are used in on-campus course development and delivery.

To increase the educational effectiveness of teleconferences, comprehensive instructional development technology must be included in the design, implementation, and evaluation stages of teleconference instruction. The following three recommendations are made. First, the teleconference population needs to be surveyed to determine exactly who watches teleconferences. Second, match the teleconference audience to the appropriate material from on-campus courses. Third, link a series of teleconferences together around the same content and design it as a telecourse. This would require students meeting student selection criteria, attendance criteria, and successful completion criteria.

Satellite teleconferencing is an education tool that can help the teachers reach large numbers of students over large geographic areas. Students do learn when this tool is used. This new tool's effectiveness, as with any tool, is totally dependant in the knowledge, skills, and abilities of the user.

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